

REMARKS

The applicant respectfully requests reconsideration in view of the following remarks. Claims 1, 23, and 30 have been amended in light of the Office Action. Upon review of the claims, claims 1 and 30 have been amended to clarify the claims and to avoid a possible 35 U.S.C. 112, rejection. Claim 31 has been amended to correct a typographical error from a prior amendment. No new matter has been added. The scope of the claims is the same. The amendment does not raise new consideration or require a new search.

Claims 1, 3-24, and 28-34 were rejected under 35 U.S.C. 103(a) as being unpatentable over Bjerrum et al. (WO 01/18894) (Bjerrum) in view of Buchanan et al. (US 5,759,944) (Buchanan). Claims 2 and 25-27 were rejected under 35 U.S.C. 103(a) as being unpatentable over Bjerrum in view of Buchanan and in further view of Kiefer et al. (US 2005/0084727) (Kiefer). The Applicants respectfully traverse these rejections.

Prior Art Rejections

Claims 1, 3-24, and 28-34 were rejected under 35 U.S.C. 103(a) as being unpatentable over Bjerrum in view of Buchanan and Kiefer. Claims 2 and 25-27 were rejected under 35 U.S.C. 103(a) as being unpatentable over Bjerrum in view of Buchanan and in further view of Kiefer.

The Applicant's claimed invention is directed to a membrane electrode unit comprising

- A) at least one polymer membrane which includes at least one polymer with at least one nitrogen atom, the polymer membrane including at least one mineral acid,
- B) at least two electrodes,

wherein at least one electrode includes a catalyst containing

- i. at least one precious metal of the platinum group, and/or at least one precious metal Au and/or Ag and
- ii. at least Ni.

Bjerrum discloses MEU having a polymer electrolyte membrane (PEM) overlapping with the PEM as currently claimed. As the Examiner has correctly stated at page 3 of the office action, Bjerrum teaches to use alloyed catalyst based on Pt and Pt/Cr, Pt/Ti, Pt/W but does not disclose a catalyst of Pt/Ni alloy (page 16, lines 20-26 of Bjerrum).

Buchanan teaches to use alloyed catalyst based on Pt or Pt/alloy and Au (gold). It is true that Buchanan lists various alloy metals which form the Pt/alloy, including one or more of Ti, Cr, Mn, Fe, Co, Ni, Cu, Ga, Zr and Hf (see col. 1, lines 60-66). From this listing, the Examiner concludes that Ti and Ni are considered to be functionally equivalent. Therefore, according to the Examiner, one would exchange the Ti in the Pt/Ti alloy known from Bjerrum as taught by Buchanan.

However, the Examiner seems to ignore the following:

- a) Buchanan relates to acid electrolyte which are not polymer as currently claimed (col. 1, lines 7-9);
- b) If one would consider the electrolytes being “similar/equivalent”, the teaching of Buchanan is to use catalyst based on Pt or Pt/alloy and Au (gold). In other words, the teaching is to use gold in combination with the acid electrolyte to increase the performance;
- c) Comparative Examples 1 and 2 vs. Examples 3 and 4 are showing that the performance is only increased if gold is present in the catalyst system, thus Pt/Ni are not recommended for acid electrolyte.

Buchanan mentions Pt/Ni alloy for acid electrolyte but teaches to use gold as catalyst component.

The conclusion of the Examiner (see page 3, middle of page) that “*it would be obvious to one of ordinary skill in the art to substitute the Pt/Au/Ni catalyst layer of Buchanan for the Pt/Ti catalyst layer of Bjerrum, because Kiefer teaches that they are recognized equivalents*” is not reasonable. The applicant does not believe that Kiefer contributes anything going beyond the teaching of Buchanan (phosphoric acid electrolyte systems) and Bjerrum (polyazole/phosphoric acid system).

The problem underlying the instant invention is to provide a catalyst system (Pt/Ni)

having improved performance for polyazole (polymer with at least one nitrogen atom)/mineral acid (phosphoric acid) systems. The instant inventors found that by using Pt/Ni catalysts higher power densities can be drawn from such MEU (see page 35 of the instant specification and examples). Starting from Bjerrum, the person of ordinary skill in the art knows that non-alloyed and alloyed catalyst based on Pt and Pt/Cr, Pt/Ti, Pt/W are suitable for such polymer electrolyte systems. Bjerrum teaches that alloys made of Pt/Ru provide improved tolerance against carbon monoxide (CO) which is a poison for Pt catalysts, in particular for direct methanol fuel cells (DMFC) (see page 3, lines 4-10). There is no teaching provided by Bjerrum which steps have to be taken to improve the performance of a catalyst for polyazole/phosphoric acid PEM. In particular, there is no teaching for Pt/Ni alloy catalyst provided.

This shortcoming of Bjerrum, according to the Examiner, should be overcome by combining Bjerrum and Buchanan. However, the teaching of Buchanan for acid electrolytes (which are liquids of phosphoric acid, typically in a SiC matrix absorbed) is to use Au (gold) as Pt/Ni/Au catalyst rather than using the comparative examples Pt/Ni. In contrast, Buchanan teaches away from using the comparative examples Pt/Ni for acid electrolytes. The applicant believes the Examiner picks individual elements from Buchanan and combines them while already knowing the solution to the instant problem. Therefore, a person of ordinary skill in the art would not combine the isolated features known from a different teaching, namely to use gold as catalyst component, to combine them in a new manner. Hence, the applicant believes that the instant invention is non-obvious.

Kiefer relates to proton conductive membranes based on a polymer film (polyazole) which is doped with vinyl-phosphonic acid monomers. The PEM taught by Kiefer is based on polyazole but does not contain a mineral acid (such as phosphoric acid). It is true that in paragraph no. [0126] it is mentioned that the liquid in step a) may comprise phosphoric acid. However, there is no teaching provided by Kiefer that alloyed catalyst, especially based on an alloy with nickel, improve the performance of the MEA. Therefore, there is no teaching provided by Kiefer of which steps have to be taken to improve the performance of a catalyst for polyazole/phosphoric acid PEM.

A statement that modifications of the prior art to meet the claimed invention would have been “obvious to one of ordinary skill in the art at the time the invention was made” because the

references relied upon teach that all aspects of the claimed invention were individually known in the art is not sufficient to establish a *prima facie* case of obviousness without some objective reason to combine the teachings of the references. *Ex parte Levengood*, 28 USPQ2d 1300 (Bd. Pat. App. & Inter. 1993). See MPEP § 2143.01 IV. “[R]ejections on obviousness cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *KSR International Co. v. Teleflex Inc.*, 82 USPQ2d 1385, 1396 (2007) quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006). Furthermore, the Examiner cannot selectively pick and choose from the disclosed parameters without proper motivation as to a particular selection. The mere fact that a reference may be modified to reflect features of the claimed invention does not make the modification, and hence the claimed invention, obvious unless the prior art suggested the desirability of such modification. *In re Mills*, 916 F.2d 680, 682, 16 USPQ2d 1430 (Fed. Cir. 1990); *In re Fritch*, 23 USPQ2d 1780 (Fed. Cir. 1992). Thus, it is impermissible to simply engage in a hindsight reconstruction of the claimed invention where the reference itself provides no teaching as to why the applicant’s combination would have been obvious. *In re Gorman*, 933 F.2d 982, 987, 18 USPQ2d 1885, 1888 (Fed. Cir. 1991).

Neither Bjerrum nor Buchanan teaches that a catalyst comprising nickel and a platinum group element and/or silver can be used as a component of a membrane electrode unit in order to improve the power density that can be drawn from that membrane electrode unit. Thus, the Office Action engages in impermissible hindsight reconstruction of the claimed invention. Furthermore, Buchanan teaches that the presence of gold is critical to achieve improved activity and performance of the catalysts (col. 4, lines 44-47). However, gold is not a required component of independent claim 1. For at least these reasons, this rejection should be withdrawn.

In view of the above amendment and arguments, Applicants believe the pending application is in condition for allowance.

Applicants believe no fee is due with this response. However, if a fee is due, please charge our Deposit Account No. 03-2775, under Order No. 15588-00042-US from which the undersigned is authorized to draw.

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Respectfully submitted,

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